



**Conference 2000**

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## ***System Diagnostic Approach for Tracking HVAC Performance***

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[www.epa.gov/labs21century](http://www.epa.gov/labs21century)



## *Presentation Overview*

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- ❑ Original Whole Building COP Concept
- ❑ Challenges of Whole Building COP
- ❑ Development of System Diagnostic Approach
- ❑ System Diagnostic Application



## ***Whole Building COP Approach***

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- ❑ Ratio of Energy Inputs and Outputs
- ❑ Typically System Level Value
- ❑ Application Examples



## ***COP Challenges at Ann Arbor***

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- ❑ Chiller/Heater Operation not Season Dependant
- ❑ Loss of Resolution with Whole Building COP
- ❑ Lack of Established Performance Metrics for Laboratories

- ❑ Snapshot of System Performance
- ❑ Baseline for Model Operation
- ❑ Component Based Measurement
- ❑ Repeatable Test Conditions
- ❑ System Flags for Inefficient Operation



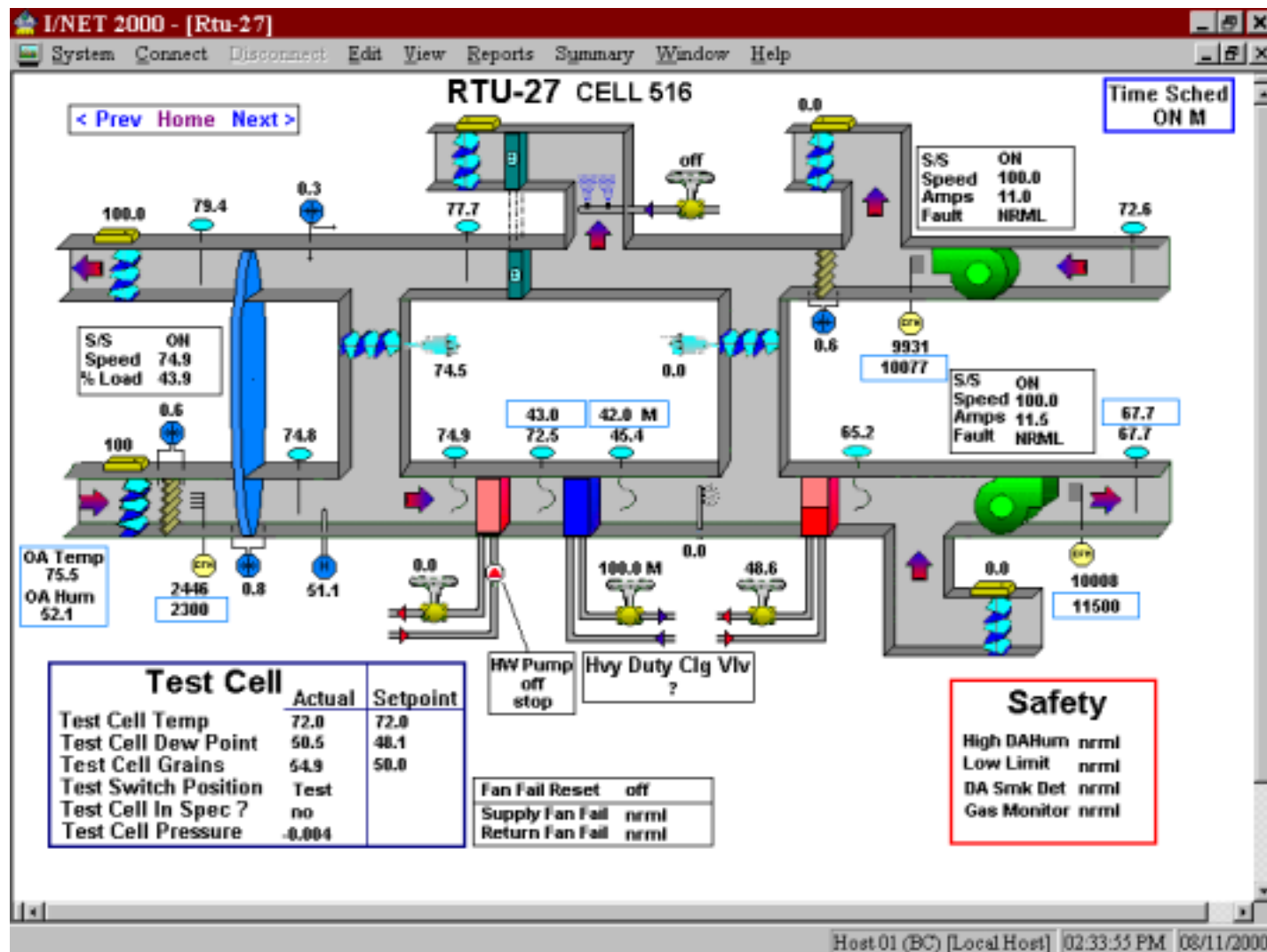
## *System Diagnostic Application*

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- ❑ Test Cell Heating & Cooling
- ❑ Heat Wheel Effectiveness
- ❑ Central Plant Heating & Cooling
- ❑ Fuel Cell Efficiency



## LABS FOR THE 21ST CENTURY



# Central Plant Control Screen

**I/NET 2000 - [Plant Controls]**

System Connect Disconnect Edit View Reports Summary Window Help

## CHILLER PLANT CONTROLS

**PLANT ENABLE** ON

**C.H1 OPERATION MODE** 0-HEAT  
1-H/C  
2-COOL H/C

**C.H2 OPERATION MODE** COOL

**PLANT SCHEDULE** ON

**LEAD CHILLER HEATER** ch#1

**LEAD CHILLER HEATER ENABLE** YES

**LAG CHILLER HEATER ENABLE** YES

**HW SYSTEM ENABLE** YES

**START 2nd HW PUMP** no

**Lead Chiller Heater Req?** YES

**Lead Chiller Heater Start** YES

**Start Lead Tower** ON

**Lag Chiller Heater Req?** no

**Lag Chiller Heater Start** no

**Start Lag Tower** ON

**Lead Cooling Tower** TVD

**Tower #1 V-6 Control** open

**V-6 Status** OPEN

**Start PCW Pump #3** ON

**Tower #2 V-7 Control** open

**V-7 Status** OPEN

**Start PCW Pump #4** ON M

**CHILLER HEATER #1 (575 TONS)**

CH/Htr #1 Ready To Start off

CH/Htr #1 Control off ?

CH/Htr #1 Status ON

CH/Htr #1 Cycle Shutdown off

CH/Htr #1 Alarm nrm

CH/Htr #1 Safety Shutdown nrm

CH/Htr #1 Secondary CWP #6 ON

CH/Htr #1 SCWP #6 Call ON

CH/Htr #1 CHW V-3 Control OPEN

CH/Htr #1 CHWP #1 Control ON

CH/Htr #1 CHWP #1 Call ON

CH/Htr #1 HWP #8 Control ON ?

CH/Htr #1 HX V-2 Control clsd

CH/Htr #1 CHW Spt 42.0 DegF

CH/Htr #1 CHWS Temp 48.3 DegF

CH/Htr #1 CHWR Temp 58.0 DegF


CH/Htr #1 Tons 528.0 Tons

CH/Htr #1 80% LOADED no

CH/Htr #1 MAXED OUT TMR 0 Min

CH/Htr #1 MAXED OUT no

**LEAD**



**CHILLER**

**CHILLER HEATER #2 (440 TONS)**

CH/Htr #2 Ready To Start off

CH/Htr #2 Control off ?

CH/Htr #2 Status ON

CH/Htr #2 Cycle Shutdown off

CH/Htr #2 Alarm nrm

CH/Htr #2 Safety Shutdown nrm

CH/Htr #2 Secondary CWP #7 ON

CH/Htr #2 SCWP #7 Call ON

CH/Htr #2 CHW V-5 Control OPEN

CH/Htr #2 CHWP #2 Control ON

CH/Htr #2 CHWP #2 Call ON

CH/Htr #2 HWP #9 Control off ?

CH/Htr #2 HX V-4 Control clsd

CH/Htr #2 CHW Spt 42.0 DegF

CH/Htr #2 CHWS Temp 45.7 DegF

CH/Htr #2 CHWR Temp 58.0 DegF

CH/Htr #2 Tons 188.0 Tons

CH/Htr #2 80% LOADED no

CH/Htr #2 MAXED OUT TMR 0 Min

CH/Htr #2 MAXED OUT no

**LEAD CH/Htr ALARM** NORMAL

**LAG CH/Htr ALARM** NORMAL

**\*\*CH/Htr ALARM RESET** off

**\*\*ALARM MUST BE RESET BEFORE CHILLER/HEATER IN ALARM IS RELEASED TO RUN AUTOMATICALLY**

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## ***Fuel Cell Efficiency***

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**Fuel Cell Efficiency equals the sum of the  
KW output plus the Waste Heat Energy  
divided by the Energy of the fuel  
consumed**

- ❑ Currently programming logic
- ❑ Component operation will be trended during initial commissioning
- ❑ Ongoing results will be reviewed for further tuning of diagnostic approach



**Thank You!**